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(56) Documents Cited

EP 0503750 A1

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(58) Field of Search

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(54) Changing roller-mounted printing plates

(57) A printing machine comprises a series of printing units each provided with a generally vertical support to support a flexographic printing plate, enabling the lower end of the plate to be fixed to a roller which can be turned through one revolution to wind the plate about the roller, the upper edge of the plate being released on completion of the revolution. Plate removal is effected by the reversal of this procedure. Blanks are fed through the machine by a chain and gripper system using endless chains having one run located substantially in the feed plane, and the rollers are grooved and recessed to accommodate the grippers as they pass through the roll nips.

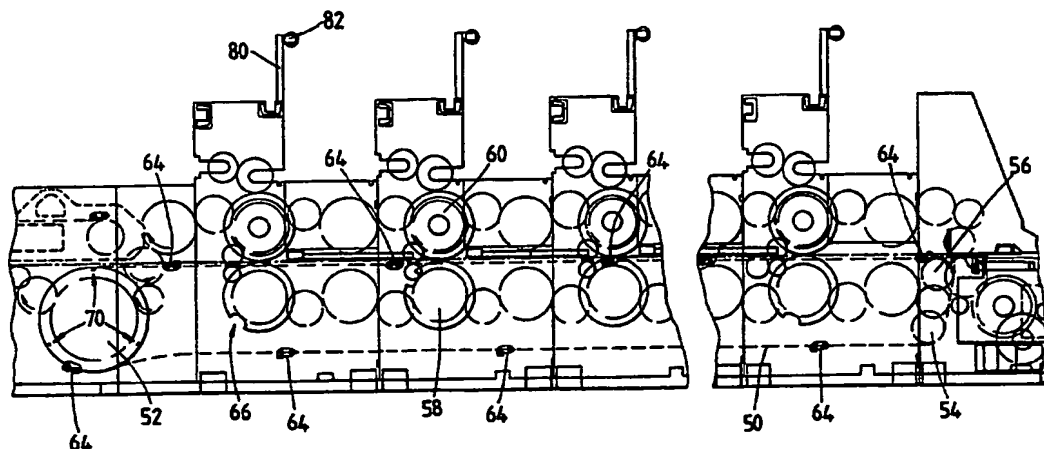


Fig. 2

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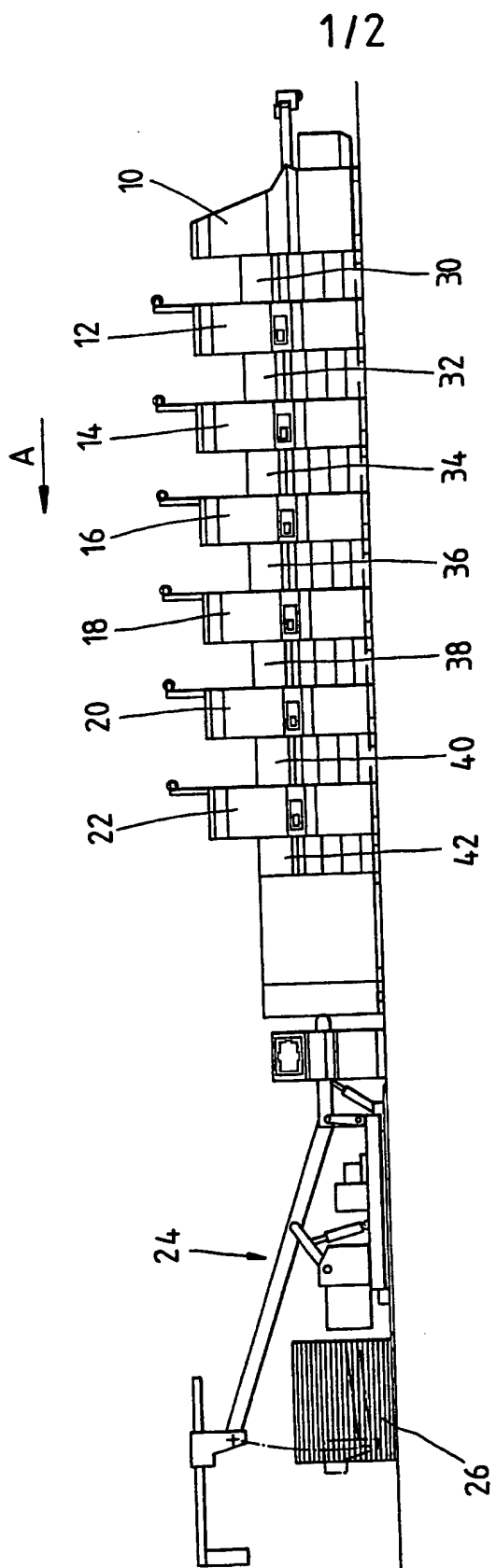


Fig. 1

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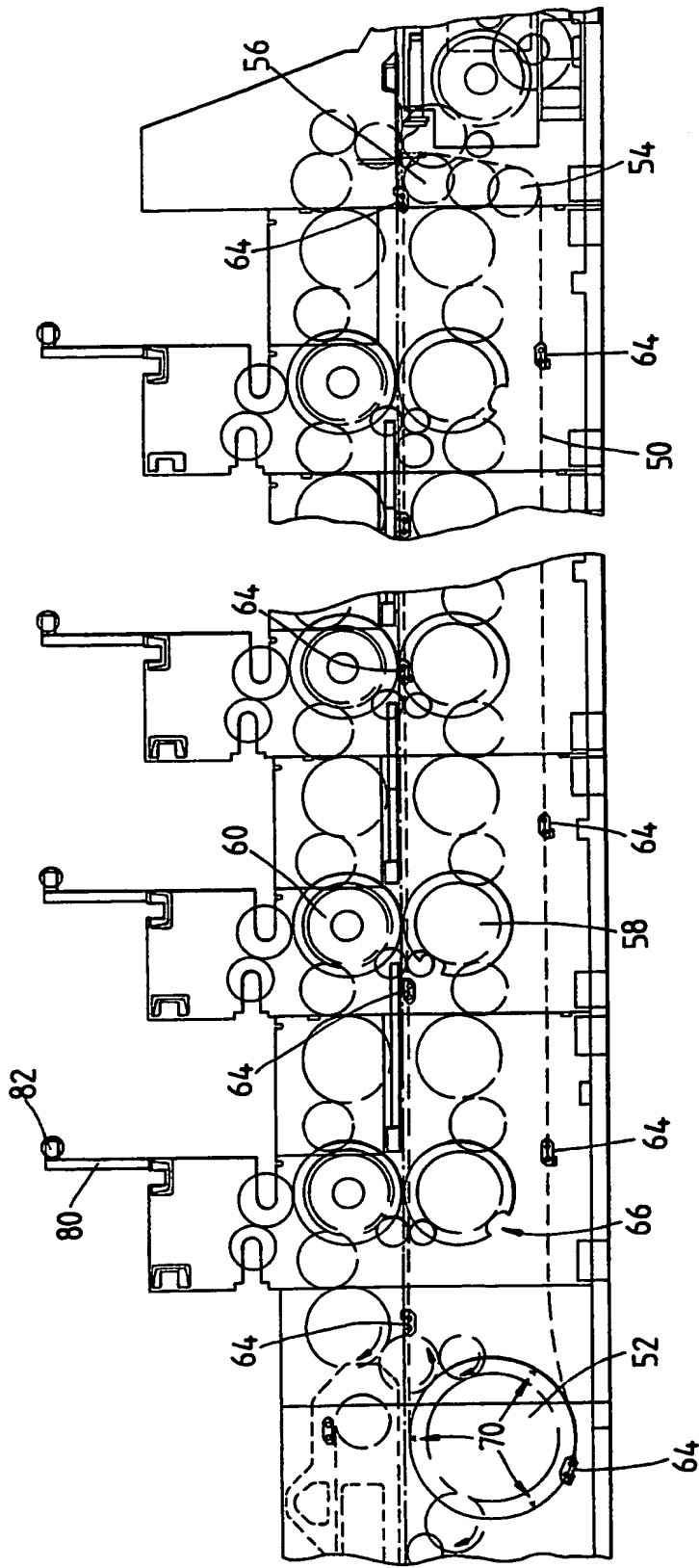


Fig. 2

BOARD CONVERTING APPARATUS

This invention relates to board converting apparatus for treatment of individual blanks of card, cardboard or like sheet material which is fed in timed relation to a number of successive units of the apparatus. The units may be for example individual colour printing sets which comprise roll pairs, that is upper and lower drum-like parts one of which forms an anvil or impression cylinder and the other (usually the upper of the pair which have their axes located in a common vertical plane) carries the treatment means for example a flexographic printing plate.

Roll diameter is dictated by the need for the circumference of the treatment roll to be substantially equal to the length of the largest blank which is to be treated. Any one conversion apparatus is used on a continually changing succession of different blank lengths, widths and thicknesses, as one production run is succeeded by another and so on, so that the full circumference is not always used.

The roll pairs, i.e. the units, are necessarily spaced apart in the feed direction by the need to accommodate further means such as ink delivery systems, gear drives, driers and the like between the successive roll pairs.

The conventional transfer means for moving the blanks onwardly through the apparatus comprises feed roll pairs of relatively small diameter as compared to the roll pairs of the treatment units to push the blanks through the apparatus. The smallness allows them to be located adjacent the nip between the treatment roll pairs as well as at further locations along the length of the apparatus.

One problem is that efficient drive of the board is produced by gripping the board between the feed roll pairs which necessarily crushes the board albeit slightly. The feed rolls must also contact the whole of

the width of the blank, in which case they may pick up newly applied ink and hence risk spoiling the clarity of the printed image, or alternatively the rolls have radially projecting collars or ridges for example at their ends so as to grip the lateral edges of the blanks, perhaps in an area which later becomes scrap, but in that case an even greater crushing action would be necessary to obtain the required grip from the small area of contact, and difficulty arises if the blanks are of a width less than the actual spacing between those collars often necessitating complex setting operations between production runs. Moreover, any and all of these factors can change from one production run to the next if the board thickness is changed, necessitating further down time in adjustment of the machine ready for the next production run. These gripping systems work best with corrugated board which is both stiff and locally crushable. Thin card cannot be handled at all by these means because of buckling.

Another down-time problem is because printing machines may be used for short or long runs but nevertheless are out of use between runs whilst the plates are removed and new plates installed. Moreover, with modern colour printing techniques, a machine may comprise many for example six treatment units each provided with a separate plate and each provided with a separate ink supply, and certain components of the ink supply system also (may) need to be changed over between successive production runs on different work. When running, one operator may be able to control several machines, but this means that there is only one operator available to do the necessary work to change a machine ready for a new run and the time required for the change-over becomes a vital factor in the economics of the operator.

The objects of the invention are to provide improvements.

According to one aspect of the invention a method of mounting a flexographic printer plate on a treatment roll

comprises hanging the plate from a mast located generally vertically above the roll, so that the plate extends vertically and generally tangentially of the roll to which it is to be attached, engaging the lower end of the plate with fastening means on the roll, turning the roll about its axis so as to wind the plate onto its surface whilst the upper end of the plate relative to the mast via a movable attachment, releasing the plate from the said attachment and engaging it with the roll at its trailing end.

According to another aspect of the invention, apparatus for carrying out the method comprises a mast extending above the roll pair, and movable attachment means mounted on the mast.

Preferably each of the printing units is provided with a separate mast with its own attachment means. The movable means may be extensible e.g. elastomeric cords hook-engaged with the mast and plate, but constant tension coiled extender devices of the kind used for measuring tapes with gripper means for plate engagement could be employed, or alternatively instead of using resilient systems the attachment means may be moved by a motor drive.

In a further aspect of the invention, the reverse action is used to unload used plates, that is to say the method comprises releasing a trailing end of a flexographic plate from its roll, engaging a movable attachment means with that disengaged end, turning the roll in a direction which allows the flexographic plate to unwind and extend generally tangentially of the roll in an upward direction whilst the attachment means move relative to the mast and then disengaging the leading end of the plate to allow the plate to hang in a generally planar condition.

One and the same apparatus may be used to carry out both methods, that is to say unload used plates and load new plates.

According to another aspect of the invention we provide board treatment apparatus comprising a number of blank treatment units (one or more) arranged in series and having a chain and gripper transfer system arranged to pull blanks through the units.

The arrangement may be such that blanks are fed from a stack one by one and in timed relation by a reciprocating suction plate, so that the leading edge of the blank becomes aligned with for example a pair of gripper jaws carried by parallel chains. The gripper jaws may be closed by means of cam tracks or engagement with fixed abutments as the blank and jaws move past those abutments.

Preferably the chains run in endless loops so as to have an upper run extending generally in the feed plane i.e. through the successive nips between the rolls and the successive printer or like units and with a lower run below the lower rolls returning the grippers for re-use in successive cycles. The grippers may be spaced apart along the chains at unit intervals slightly in excess of the maximum blank length required and precisely equal to the circumferential dimension of each of the treatment rolls.

According to one important feature of the invention an adjuster is provided in the chain between each two successive grippers enabling gripper spacing to be adjusted and maintained within very narrow limits. According to another important feature of the invention the chain is driven by sprocket means arranged to make drive connection with the chain only at intervals equal to the gripper spacing.

Preferably the grippers engage the blank at points slightly closer than the minimum acceptable blank width, and in fact serve to set a value for that width. The grippers will therefore always pick up on blanks at the lead edge irrespective of whether it is a minimum or a maximum width blank. This possibility enables the roll

pairs or ones of them, preferably the impression rolls to be made with recesses in their arcuate surfaces, and those recesses to be synchronised in rotation relative to the position of the grippers, so as to allow the grippers to pass through the nips between the rolls although the grippers are of a thickness substantially greater than the dimension of the nip. It will be appreciated that the blank will trail from the engaging grippers and generally rest upon support rails or similar between successive treatment units. Also the impression cylinder may also be peripherally grooved as well as having a recess at one particular position, so as to allow the chains and adjusters to extend tangentially through the grooves.

It will be appreciated that apparatus having axially short rolls may have a suitable single gripper design for relatively small blanks and a single chain; and conversely for particularly long rolls for wide blanks more than two chains may be provided so that each blank may be engaged by more than two grippers: however, the normal arrangement will be two chains as discussed.

The grippers may be of any desired formation for example having serrated jaws or ones provided with yielding material to ensure good grip upon the blank depending upon the nature of the blank material.

The apparatus may be provided with a separate transfer system at the opposite end to the inlet feed system for example using a relatively short chain conveyor provided with separate grippers, with the two chains arranged to interact so that as the first set of grippers release the blank as it emerges from the last of the treatment units, the grippers of the second conveyor engage with that blank to carry it onwards to a stack forming apparatus.

According to another preferred feature of the invention, the upper rolls of each unit are the treatment rolls and are fixed in position, that is to say no vertical adjustment is provided (contrary to the usual

practice in the industry) and the lower roll of each unit is vertically adjustable in order to compensate for variations in board thickness. This means that the printing plane remains constant irrespective of thickness.

Where there are several successive treatment units, synchronization becomes particularly important and for this reason it is preferred to use anti-backlash gears transmitting drive between the successive units.

The invention is now more particularly described with reference to the accompanying drawings wherein:-

Figure 1 is a diagrammatic elevation showing a printing machine; and

Figure 2 is a fragmentary but more detailed view on a larger scale of the same.

The machine shown in Figure 1 comprises a feeder 10 which may for example top feed from a rising stack or bottom feed from a descending stack of prepared blanks, or simply transfer blanks one by one from a conveyor. The blanks are fed in the direction of the arrow A through a series of, in this specific embodiment, six separate printing units 12-22 delivering the blanks via a stacker generally indicated by the reference 24 to form a stack 26. Separate dryer means 30-42 are located adjacent each printing unit.

It will be appreciated that the number of printing units varies according to the complexity of the printing being undergone. The board treatment units may effect other operations on the blanks. However, the invention is particularly concerned with situations where the treatment effected by the separate units is to be aligned or synchronised in register.

Turning now to Figure 2, blanks are fed through the machine by a pair of gripper chains 50 which extend in endless runs side by side through the length of the machine. The lower run of the chains extends between the

main drive drum 52 and the tail drum 54 below the impression cylinders and the upper run extends from a further drum 56 above the tail drum 54 and substantially in the feed plane, through the nip between the roll pairs of the successive units up to the drive drum 52. Each unit comprises an impression cylinder 58 and a printing cylinder 60 on which a flexographic printing plate is mounted having axes in a common plane perpendicular to the feed plane. The cylinders 58,60 are of a common diameter. Between the successive units are drive train gears which maintain all of the printing rolls and impression rolls in synchronism.

The drive chains are provided with grippers 64 which are pitched apart by a distance precisely identical to the peripheral measurement of the printing rolls and impression rolls. The impression rolls are provided with recesses 66 to accommodate the grippers as they pass through the roll nips and the synchronism ensures that each gripper drops into place in a recess as it passes through the nip. Midway between each two grippers along the length of the chain is a corresponding adjuster. The chain may be a conventional roller chain which, albeit lightly stressed possibly due to being over specified is nevertheless subject to wear in the course of time, which causes the chain to stretch and this would, in the absence of adjusters, create problems. Effectively each length of chain between two grippers is made up of two lengths of chain connected by the adjuster and the adjuster can draw the two lengths together so as to shorten the total distance between two adjacent grippers when wear occurs to bring it back to the required pitch.

The drive drum 52 is provided with a sprocket, having, in this particular embodiment, three equi-spaced teeth 70 for engagement with the train. The teeth are spaced apart on the surface of the drum by the gripper pitch so that only one tooth will engage in each chain portion between a gripper and the adjuster, so that the (albeit small) adjustments made in the length of chain between each two grippers will not affect sprocket engagement with the chain.

Each of the printing units is provided with a mast 80 provided with a drive device 82 at its upper end. The distance between the drive device 82 and the nearest point on the adjacent printing cylinder vertically below that device is equal to the length of the flexographic printing plate to be used with the machine, which is slightly less than the circumferential dimension of the printing roll or the spacing of the grippers. A perpendicular line from the device 82 meets the corresponding printing roll tangentially of the same.

The flexographic plate installation system, from a point when there is no plate installed, consists of hanging the plate from the device 82 so that it extends vertically and touches the printing roll tangentially at or near the feed plane, engaging that end with the roll by means of the usual fixing devices provided on the roll, inching the corresponding roll through one revolution so as to wind the plate about the roll whilst the upper end of the plate descends from the device 82, which may for example be braked to control the movement, and then when the trailing end of the flexographic plate reaches the cylinder, engaging the further clamp means and releasing connection to the device 82 which are then re-wound or raised either by a motor or spring means. When this has been done for all of the printing cylinders with their corresponding plates, the machine can be put into use. The reverse operation is used to de-install the plates.

CLAIMS

1. A method of mounting a flexographic printing plate on a treatment roll comprises hanging a plate from a mast located generally vertically above the roll so that the plate extends in a vertical plane and generally tangentially of the roll to which it is to be attached, engaging the lower end of the plate with fastening means on the roll, turning the roll about its axis so as to wind the plate onto its surface whilst the upper end of the plate descends relative to the mast via a movable attachment, releasing the plate from the said attachment and engaging it with the roll at its trailing end.
2. A method of de-installing a flexographic printer plate from a roll comprising releasing the trailing end of the plate, engaging a movable attachment means with that disengaged end, turning the roll in a direction which allows the flexographic plate to unwind and extend generally tangentially of the roll in an upward direction, moving the said attachment means relative to a mast extending vertically above the roll until the plate extends in a vertical plane, and then disengaging the leading end of the plate from the roll to allow the plate to hang in the planar condition prior to removal.
3. Apparatus for carrying out the method of Claim 1 or Claim 2 comprising a mast extending above the roll pair and movable attachment means mounted on the mast.
4. A flexographic printing apparatus comprising a plurality of treatment units each as claimed in Claim 3.
5. Board treatment apparatus comprising a number of blank treatment units (one or more) arranged in series and having a chain and gripper transfer system arranged to pull blanks through the units.
6. Apparatus as claimed in Claim 5 wherein the chains run in endless loops with an upper run extending in the feed plane through the nips between the rolls and the lower run located below the rolls, the rolls being

grooved and recessed to permit the chains and grippers to pass through the nips therebetween.

7. Apparatus as claimed in Claim 5 wherein the grippers are spaced apart long the chain by a dimension precisely equal to the circumference of the treatment roll, and an adjuster is provided between each two grippers for wear compensation.

8. Apparatus as claimed in Claim 7 wherein the chain runs around a drive sprocket having teeth circumferentially spaced at the gripper pitch along the chain.

9. Apparatus as claimed in any preceding claim wherein each treatment unit comprises a pair of cylinders of common diameter, the upper cylinders form the printing units and are fixed in position, and the lower units form the impression cylinders and are vertically adjustable to accommodate varying blank thicknesses.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
The Search report)

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Relevant Technical Fields

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(ii) Int Cl (Ed.5) B41F 27/00, 27/12

Search Examiner
MR G D WILLIAMS

Date of completion of Search
1 JULY 1994

Databases (see below)

- (i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
1-4

(ii)

Categories of documents

- X:** Document indicating lack of novelty or of inventive step. **P:** Document published on or after the declared priority date but before the filing date of the present application.
- Y:** Document indicating lack of inventive step if combined with one or more other documents of the same category. **E:** Patent document published on or after, but with priority date earlier than, the filing date of the present application.
- A:** Document indicating technological background and/or state of the art. **&:** Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
X	EP 0503750 (KOMORI) see whole document	1
A	EP 0431575 (KOMORI) see whole document	1
X	US 5127328 (KOENIG & BAUER) see Claim 1	1
X	US 5111744 (KOENIG & BAUER) see column 2, lines 10-35	1
X	US 4408530 (MITSUBISHI) see column 2, lines 29-30	1
A	US 4368668 (VEB KOMBINANT) see whole document	1

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